

FUTURE MARS OUTPOST ARCHITECTURE

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NASA's Mars exploration program includes major science goals related to life, climate, geology, and preparation for human exploration. From these goals, several science objectives and specific investigations have been derived. Examples of such investigations include mapping subsurface water and ice deposits. The program also has the goal of demonstrating enabling technology for future human exploration.

Several of the keystone investigations, as well as the human exploration goal, are enabled by long-term, continuous surface presence with logistical support. This can be achieved with a series of progressive missions that establish and maintain a long-lived robotic presence, or a Mars Outpost. Such an outpost would allow for extended scientific experiments to collect continuous data sets, utilizing multiple missions to add/restore experimental capability, and a long-lived, high power (probably nuclear) central energy source to alleviate previous tight power usage constraints. These characteristics also enable increased mobility to allow investigation over an extended region.

In an effort to understand the issues associated with robotic outpost design, the Mars Long Range Planning Team (MLRP) developed a "heuristic" Mars Outpost scenario. This scenario was intended to explore/expand the current design space and incorporate (or spur) new technology development. Major goals included identifying: (1) which science objectives benefit most from an outpost setting, (2) key technology needs to fulfill mission requirements, (3) current investments necessary to assure timely maturity of such technologies, and (4) operational/logistical hurdles associated with multi-mission planning.

This paper describes a robotic outpost designed with the above-mentioned goals in mind. This design focuses on the creation of a three-dimensional map of the subsurface in a specific region, to be accomplished via deep drilling. This can lead to the fulfillment of a range of science objectives, particularly those dealing with subsurface exploration and characterization, and the search for water and life. In addition to the space science goals, the outpost design included resource allocations for human precursor demonstrations.